U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

SCIENTIFIC NAME: *Pseudognaphalium sandwicensium* var. *molokaiense*

COMMON NAME: ʻEnaʻena

LEAD REGION: Region 1

INFORMATION CURRENT AS OF: April 2010

STATUS/ACTION

___ Species assessment - determined we do not have sufficient information on file to support a proposal to list the species and, therefore, it was not elevated to Candidate status
___ New candidate
_X__ Continuing candidate
___ Non-petitioned
_X__ Petitioned - Date petition received: May 11, 2004
_ 90-day positive - FR date:
X 12-month warranted but precluded - FR date: May 11, 2005
N Did the petition request a reclassification of a listed species?

FOR PETITIONED CANDIDATE SPECIES:
a. Is listing warranted (if yes, see summary of threats below)? Yes
b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? Yes
c. If the answer to a. and b. is "yes", provide an explanation of why the action is precluded.
Higher priority listing actions, including court-approved settlements, court-ordered and statutory deadlines for petition findings and listing determinations, emergency listing determinations, and responses to litigation, continue to preclude the proposed and final listing rules for the species. We continue to monitor populations and will change its status or implement an emergency listing if necessary. The "Progress on Revising the Lists" section of the current CNOR (*http://endangered.fws.gov/*) provides information on listing actions taken during the last 12 months.

_N_ Listing priority change
Former LP: ___
New LP: ___
Date when the species first became a Candidate (as currently defined):
December 15, 1980
___ Candidate removal: Former LPN: ___
___ A – Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.

___U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.
___ F – Range is no longer a U.S. territory.
___ I – Insufficient information exists on biological vulnerability and threats to support listing.
___ M – Taxon mistakenly included in past notice of review.
___ N – Taxon does not meet the Act's definition of "species."
___ X – Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Flowering plants, Asteraceae (Sunflower family)

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, islands of Molokai, Maui, Lanai, and Oahu

CURRENT STATES/COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, islands of Molokai and Maui

LAND OWNERSHIP: *Pseudognaphalium sandwicensium* var. *molokaiense* is found on State and private land.

LEAD REGION CONTACT: Linda Belluomini, (503) 231- 6283, linda_belluomini @fws.gov

LEAD FIELD OFFICE CONTACT: Pacific Islands Fish and Wildlife Office, Christa Russell, (808) 792-9400, christa_russell@fws.gov

BIOLOGICAL INFORMATION

Species Description

Pseudognaphalium sandwicensium var. *molokaiense* is a perennial herb, 3.9 to 25 inches (in) (10 to 64 centimeters (cm)) tall with moderate to densely woolly pubescence. Stems are olive green to white or gray and vary in their degree of erectness and branching. Leaves are linear with both surfaces densely wooly pubescent. Whitish to pale yellow flower heads occur in terminal, leafless clusters. This variety is distinguished from other varieties of the species in that the entire plant is covered in very dense white wooly pubescence; the stems are prostrate to sometimes erect, 3.9 to 11.8 in (10 to 30 cm) long; the leaves are spatulate to narrowly obovate with the lower ones usually 0.3 to 0.8 in (7 to 20 millimeters (mm)) wide; and only the tips of the involucral bract in the flower heads are exposed while the remainder is densely wooly pubescent (Wagner *et al*. 1999a).

Taxonomy

First described by Sherff and Degener (1948) as an infraspecific taxon in the genus *Gnaphalium*, Wagner (1997) moved the entire species to *Psuedognaphalium*. This variety is recognized as a distinct taxon in Wagner *et al*. (1999a, p. 321-322) and Wagner and Herbst (2003, p. 8), the most recently accepted Hawaiian plant taxonomy.

Habitat/Life History
Typical habitat is strand vegetation in dry consolidated dunes (Wagner *et al*. 1999a, p. 321-322).

Historical Range
Historically, this species was found on four Hawaiian Islands. It occurred on Molokai in Halawa Valley and Waiahewahewa gulch, on Oahu at Diamond Head and along the Waimanalo coast, on Maui in the Wailuku area, and on Lanai along the Munro trail (Hawaii Biodiversity and Mapping Program (HBMP) 2008).

Current Range/Distribution
Currently, this species is found on Molokai on the northwestern coast at Ilio Point, Moomomi Preserve, and Nenehanaupo; and on Maui in the Waiehu dunes and on Puu Kahulianapa sea cliff (HBMP 2008).

Population Estimates/Status
Currently this variety is now known from five populations along the northwest coastline of Molokai totaling 100s to perhaps as many as 20,000 individuals depending on rainfall; and from two populations on the northwest coast of Maui, one at Waiehu dunes (scattered individuals) and the second at Puu Kahulianapa (5 to 10 individuals) (F. Starr, U.S.G.S. Biological Resources Discipline, pers. comm. 2006; W. Moses, The Nature Conservancy of Hawaii, pers. comm. 2006; R. Kallstrom, The Nature Conservancy (TNC), pers. comm. 2008). It was last observed on Oahu on Diamond Head crater (5 individuals) in the 1980s (HBMP 2008).

THREATS

A. The present or threatened destruction, modification, or curtailment of its habitat or range. *Pseudognaphalium sandwicensium* var. *molokaiense* is threatened by feral goats (*Capra hircus*), and axis deer (*Axis axis*) that adversely modify habitat (HBMP 2008; W. Moses, pers. comm. 2006; F. Starr, pers. comm. 2006; R. Kallstrom, pers. comm. 2008). Goats are being raised near the Puu Kahulianapa population on Maui (F. Starr, pers. comm. 2006).

The goat, a species originally native to the Middle East and India, was successfully introduced to the Hawaiian Islands in 1792. Currently, populations exist on Kauai, Oahu, Maui, Molokai, and Hawaii. Goats browse on introduced grasses and native plants, trample roots and seedlings, cause erosion, and promote the invasion of alien plants. They are able to forage in extremely rugged terrain and have a high reproductive capacity (Clarke and Cuddihy 1980; van Riper and van Riper 1982; Scott *et al*. 1986; Tomich 1986; Culliney 1988; Cuddihy and Stone 1990). The effects on mesic and wet forest habitat by the foraging of feral goats have also been reported in fencing studies. An exclosure analysis demonstrated that release from goat pressure by fencing resulted in an immediate recovery in height growth and numbers of vegetative resprouts of the native tree *Acacia koa* (Spatz and Mueller-Dombois 1973). Another study at Puuwaawaa on the island of Hawaii demonstrated that prior to management actions in 1985, regeneration of endemic shrubs and trees in the grazed area was almost totally lacking, contributing to the invasion of the forest understory by exotic grasses and weeds. After the removal of grazing animals in 1985, koa and *Metrosideros* spp. (ohia) seedlings were observed geminating by the thousands (Department of Land and Natural Resources 2002).

Axis deer were introduced to Molokai in 1868, and within 30 years the population was estimated at 7,000 animals. By 1996, the population at Kalaupapa had remarkable negative impacts on the vegetation (Dorman 1996). Axis deer eat native vegetation, trample roots and seedlings, cause erosion, and promote the invasion of alien plants, and can jump fences constructed for feral pig control. The interaction of feral pigs and axis deer has reduced the *Metrosideros-Cibotium* (ohia-hapuu) rain forest to a grassy scrubland (Dorman 1996). Axis deer have moved from their preferred habitat in relatively open, lower elevation shrub areas, into the rain forest above Halawa Valley, likely due to hunting pressure (Dorman 1996). Currently, the axis deer population is estimated to be at least 1,500 on Molokai ranch lands alone and 5,000 to 6,000 animals for Molokai and Lanai combined (Dorman 1996; P. Nicholas, Molokai Ranch, in litt. 2006). Axis deer were introduced to Maui in 1959, with five being released east of Kihei. By 1968, the Maui population was estimated to be 85 to 90 animals and currently there is concern that their numbers could expand to between 15,000 to 20,000 or more within a few years (Waring 1996; E. Nishibayashi, TNC, in litt. 2001; S. Anderson, University of California-Davis, in litt. 2001). Deer are primarily grazers, but also browse numerous plant species including those grown as commercial crops (Waring 1996; J. Simpson, Kula farmer, in litt. 2001).

Hawaiian ecosystems, having evolved without hoofed mammals, are susceptible to large-scale disturbance by introduced ungulates (Loope *et al*. 1991). Because of demonstrated habitat modifications by feral goats and wild deer, such as destruction of native plants, disruption of topsoil leading to erosion, and establishment and spread of nonnative plants; the Service believes they are a threat to this species.

B. Overutilization for commercial, recreational, scientific, or educational purposes.
Pseudognaphalium sandwicensium var. *molokaiense* may be collected for making lei (floral necklaces). Off-road vehicles are a potential threat to this variety (HBMP 2008).

C. Disease or predation.
Predation by feral goats and wild deer is a likely threat to this subspecies (HBMP 2008). Goats browse on introduced grasses and native plants, and are able to reach more remote and inaccessible areas than other ungulates. They thrive on a variety of food plants, and are instrumental in the decline of native vegetation in many areas (Cuddihy and Stone 1990). The numbers of deer on Maui have been increasing since their introduction in 1959. Damage to fencing and crops has also been reported (J. Simpson, in litt. 2001).

Because Hawaii's native plants evolved without any browsing or grazing mammals present, many lost natural defenses to such impacts (Carlquist 1980). Therefore, even though there are no observations of direct browsing on *Pseudognaphalium sandwicensium* var. *molokaiense*, it is likely that goats and deer impact this species directly.

D. The inadequacy of existing regulatory mechanisms.
Pseudognaphalium sandwicensium var. *molokaiense* currently receives no protection under Hawaii's endangered species law (HRS, Sect. 195-D) or the Federal Endangered Species Act (16 U.S.C. §1531-1544).

Goats and deer are managed as game animals in Hawaii. Goat and deer hunting is allowed on all islands either year-round or during certain months, depending on the area (Hawaii Department of Land and Natural Resources 1999, 2003); however, public hunting is not adequate to eliminate this threat to *Pseudognaphalium sandwicensium* var. *molokaiense*.

E. Other natural or manmade factors affecting its continued existence.
Alien plant species are a threat to *Pseudognaphalium sandwicensium* var. *molokaiense* as they degrade habitat and outcompete native plants (HBMP 2008; W. Moses, pers. comm. 2006). The nonnative plants reported to be the greatest threats to this species are: *Prosopis pallida* (kiawe), *Pluchea* sp. (saltbush), *Cenchrus ciliaris* (buffelgrass), and *Setaria parviflora* (foxtail) (W. Moses, pers. comm. 2006).

Cenchrus ciliaris is a grass native to Africa and tropical Asia. It is naturalized in Hawaii and common in dry areas in a wide variety of disturbed habitats. It is fire-adapted, provides fuel for fires, and recovers quickly, increasing its cover with each succeeding fire (Pacific Island Ecosystems at Risk (PIER) 2006a).

Pluchea sp. There are two species of *Pluchea* in Hawaii, *P. indica* and *P. carolinensis*, and a cross between them (*Pluchea* x *fosbergii*). *Pluchea indica* is native to southern Asia, and *P. carolinensis* is native to Mexico, the West Indies, and South America (Wagner *et al*. 1999a). This 3 to 6 ft (1 to 2 m) tall, fast-growing shrub, forms thickets in dry habitats and can tolerate saline conditions. It is widespread in Hawaii from coastal areas up to almost 3,000 ft (900 m). The seeds are wind-dispersed (Francis 2006).

Prosopis pallida was introduced to Hawaii in 1828, and its seeds were used as fodder for ranch animals. The seeds were quickly spread by ranch animals. Kiawe became a dominant component of the vegetation in low elevation, dry, disturbed sites, as it is well adapted to dry habitats. It overshadows other vegetation and the deep tap roots use all available water. This species fixes nitrogen and can outcompete native species (Wagner *et al*. 1999; PIER 2006b).

Setaria parviflora is a perennial grass native to Europe, introduced to Hawaii around 1895. This grass is naturalized in a wide variety of habitat, from wet to dry, low, to high elevations, in pastures, urban sites, and agricultural lands. The culms can be up to 4 ft (1.2 m) tall, shading and crowding out native plant species (O'Connor 1999). *Setaria parviflora* may occur as a single plant or as a significant colony (University of Florida 2005).

The original native flora of Hawaii consisted of about 1,400 species, nearly 90 percent of which were endemic. Of the total native and naturalized Hawaiian flora of 1,817 taxa, 47 percent were introduced from other parts of the world, and nearly 100 species have become pests (Smith 1985; Wagner *et al*. 1999a). Confirmed personal observations (W. Moses, pers. comm. 2006) and several studies (Cuddihy and Stone 1990; Wood and Perlman 1997; Robichaux *et al*. 1998, p. 4) indicate nonnative plant species may outcompete native plants similar to *Pseudognaphalium sandwicensium* var. *molokaiense*. Competition may be for space, light, water, or nutrients, or there may be a chemical produced that inhibits growth of other plants (Smith 1985; Cuddihy and Stone 1990). In addition, nonnative pest plants found in habitat similar to that of this species have been shown to make the habitat less suitable for native species (Smathers and Gardner

1978; Smith 1985; Loope and Medeiros 1992; Medeiros *et al.* 1992; Ellshoff *et al.* 1995; Meyer and Florence 1996; Medeiros *et al.* 1997; Loope *et al*. 2004). In particular, alien pest plant species degrade habitat by modifying availability of light, altering soil-water regimes, modifying nutrient cycling, or altering fire characteristics of native plant communities (Smith 1985; Cuddihy and Stone 1990; Vitousek *et al*. 1997). Because of demonstrated habitat modification and resource competition by nonnative plant species in habitat similar to the coastal dune habitat of *P. sandwicensium* var. *molokaiense*, the Service believes nonnative plant species are a threat to this species.

In addition, species like *Pseudognaphalium sandwicensium* var. *molokaiense* that are endemic to small islands are inherently more vulnerable to extinction than widespread species because of the higher risks posed to a few populations and individuals by genetic bottlenecks, random demographic fluctuations and localized catastrophes such as hurricanes (Pimm *et al*. 1988; Mangel and Tier 1994).

CONSERVATION MEASURES PLANNED OR IMPLEMENTED

Weed control is ongoing at the Moomomi Preserve population of *Pseudognaphalium sandwicensium* var. *molokaiense* on Molokai (The Nature Conservancy of Hawaii 2007; R. Kallstrom, pers. comm. 2008). This species is represented in an ex situ collection at Maui Nui Botanical Garden (S. Seidman, Maui Nui Botanical Garden, pers. comm. 2006).

SUMMARY OF THREATS

Based on our evaluation of habitat degradation and loss by feral goats, axis deer, and nonnative plants, we conclude there is sufficient information to develop a proposed rule for this species due to the present and threatened destruction, modification, or curtailment of its habitat and range, and the displacement of individuals of *Pseudognaphalium sandwicensium* var. *molokaiense*, due to competition with nonnative plants for space, nutrients, water, air, and light. Randomly occurring natural events are a likely threat to this variety due to small population sizes. Potential threats include destruction by off-road vehicles and collection for lei-making. We find that this species is warranted for listing throughout all of its range, and, therefore, find that it is unnecessary to analyze whether it is threatened or endangered in a significant portion of its range.

RECOMMENDED CONSERVATION MEASURES:

- Survey for populations of *Pseudognaphalium sandwicensium* var. *molokaiense* in areas of potentially suitable habitat
- Control feral goats and axis deer
- Control alien plants
- Continue propagation efforts for maintenance of genetic stock
- Reintroduce individuals into suitable habitat within historic range that is being managed for known threats to this species

LISTING PRIORITY

THREAT			
Magnitude	Immediacy	Taxonomy	Priority
High	**Imminent**	Monotypic genus	1
		Species	2
		Subspecies/population	**3***
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/population	6
Moderate to Low	Imminent	Monotypic genus	7
		Species	8
		Subspecies/population	9
	Non-imminent	Monotypic genus	10
		Species	11
		Subspecies/population	12

Rationale for listing priority number:

Magnitude:
This species is highly threatened by feral goats (Maui) and axis deer (Maui and Molokai), that degrade and destroy habitat, and by nonnative plants that compete for light and nutrients. Potential threats include collection for lei and damage or destruction of individuals and habitat by off-road vehicles. Threats to the strand vegetation in the dry consolidated dune habitat of *Pseudognaphalium sandwicensium* var. *molokaiense*, and to individuals of this species, occur throughout its range and are expected to continue or increase without their control or eradication. While weed control protects one population on Molokai, no conservation efforts have been initiated to date for the remaining populations on Molokai or on Maui.

Immediacy of Threats:
Threats to *Pseudognaphalium sandwicensium* var. *molokaiense* from feral goats and axis deer, and nonnative plants are considered imminent because they are ongoing.

Yes Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed?

Is Emergency Listing Warranted? No. The species does not appear to be appropriate for emergency listing at this time because the immediacy of the threats is not so great as to imperil a significant proportion of the taxon within the time frame of the routine listing process. Weed control protects one population of *Pseudognaphalium sandwicensium* var. *molokaiense* on Molokai. However, no conservation efforts have been initiated to date for the populations on Maui. If it becomes apparent that the routine listing process is not sufficient to prevent large losses that may result in this species' extinction, then the emergency rule process for this species

will be initiated. We will continue to monitor the status of *P. sandwicensium* var. *molokaiense* as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures.

DESCRIPTION OF MONITORING

Much of the information on this form is based on the results of a meeting of 20 botanical experts held by the Center for Plant Conservation in December of 1995. We incorporated additional information on this species from our files and the most recent supplement to the *Manual of Flowering Plants of Hawaii* (Wagner and Herbst 2003). In 2004, the Pacific Islands Office contacted the following species experts: Robert Hobdy, retired from the Hawaii Division of Forestry and Wildlife; Joel Lau, Hawaii Biodiversity and Mapping Program; Arthur Medeiros, U.S.G.S. Biological Resources Discipline; Hank Oppenheimer, resource manager for the Maui Land and Pineapple Company; and Steve Perlman and Ken Wood, National Tropical Botanical Garden. No new information was provided. In 2005 we contacted species experts, and confirmation of the status was provided by Wailana Moses of The Nature Conservancy of Hawaii. In 2006 new status information was provided by F. Starr, U.S.G.S. Biological Resources Discipline, S. Seidman, Maui Nui Botanical Gardens, and W. Moses, The Nature Conservancy of Hawaii. No new information was received in 2008. In 2009 we received new information from Russell Kallstrom. In 2010, we contacted the species experts listed below and received no new information.

List all experts contacted:

Name	Date	Affiliation
Agorastos, Nick	02/09/10	Division of Forestry and Wildlife
Anderson, Stephen	02/09/10	National Park Service, Haleakala NP, Maui
Aruch, Sam	02/09/10	private contractor
Bakutis, Ane	02/09/10	Plant Extinction Prevention Program, Molokai
Ball, Donna	02/09/10	U.S. FWS, Partners Program, Hawaii Island
Beavers, Sally	02/09/10	National Park Service, Hawaii Island
Bily, Pat	02/09/10	The Nature Conservancy, Maui
Bio, Kealii	02/09/10	Plant Extinction Prevention Program, Hawaii Island
Brosius, Chris	02/09/10	West Maui Mountains Watershed Partnership
Caraway, Vickie	02/09/10	Hawaii Division of Forestry and Wildlife, Oahu
Ching, Susan	02/09/10	Plant Extinction Prevention Program, Oahu
Cole, Colleen	02/09/10	Three Mountain Alliance
Conry, Paul	02/09/10	Hawaii Department of Land and Natural Resources
Coordinator	02/09/10	East Maui Watershed Partnership
Duvall, Fern	02/09/10	Hawaii Division of Forestry and Wildlife, Maui
Fay, Kerri	02/09/10	The Nature Conservancy, Maui
Garnett, Bill	02/09/10	National Park Service, Kalaupapa, Molokai
Giffin, Jon	02/09/10	The Nature Conservancy, Hawaii Island
Haus, Bill	02/09/10	National Park Service, Haleakala NP, Maui
Higashino, Jennifer	02/09/10	U.S. FWS, Maui
Imada, Clyde	02/09/10	Bishop Museum
Jacobi, Jim	02/09/10	U.S.G.S., Biological Resources Division

Kawakami, Galen	02/09/10	Division of Forestry and Wildlife, Kauai
Kawelo, Kapua	02/09/10	U.S. Army, Environmental Division
Kier, Matt	02/09/10	U.S. Army, Environmental Division
Kiyabu, Brian	02/09/10	Amy Greenwell Botanical Garden
Kraus, Jim	02/09/10	U.S. FWS, Hakalau NWR
Medeiros, Arthur	02/09/10	U.S. Geological Survey
Misaki, Ed	02/09/10	The Nature Conservancy, Molokai
Moriyasu, Patty	02/09/10	Volcano Rare Plant Facility, Hawaii Island
Moses, Wailana	02/09/10	The Nature Conservancy, Molokai
Nakai, Glynnis	02/09/10	U.S. FWS, Refuges, Maui
Oppenheimer, Hank	02/09/10	Plant Extinction Prevention Program, Maui Nui
Palomino, Anna	02/09/10	Olinda Rare Plant Nursery, Maui
Palumbo, David	02/09/10	National Park Service, Haleakala NP, Maui
Pepi, Vanessa	02/09/10	U.S. Navy, Environmental Contractor
Perlman, Steve	02/09/10	National Tropical Botanical Garden
Perry, Lyman	02/09/10	Division of Forestry and Wildlife, Hawaii Island
Plunkett, Bryan	02/09/10	Lanai Forest and Watershed Partnership
Pratt, Linda	02/09/10	U.S.G.S., Biological Resources Division
Purell, Melora	02/09/10	Kohala Watershed Partnership
Seidman, Stephanie	02/09/10	Maui Nui Botanical Garden
Shishido, Glenn	02/09/10	Division of Forestry and Wildlife, Maui
Silbernagle, Mike	02/09/10	U.S. FWS, Refuges, Oahu
Smith, Miranda	02/09/10	Koolau Mountains Watershed Partnership
Starr, Forest	02/09/10	U.S. Geological Survey
Tanaka, Daniel	02/09/10	Puu Kukui Watershed Preserve
Ward, Joe	02/09/10	Puu Kukui Watershed Preserve
Welton, Patti	02/09/10	National Park Service, Haleakala NP, Maui
Wood, Ken	02/09/10	National Tropical Botanical Garden
Wysong, Michael	02/09/10	DLNR Natural Area Reserves, Kauai

The Hawaii Biodiversity and Mapping Program identified this species as vulnerable (HBMP 2006). Based on the International Union for Conservation of Nature and Natural Resources Red List of Threatened Species, this species is recognized as Endangered (facing a very high risk of extinction in the wild) by Wagner *et al*. (1999b). *Pseudognaphalium sandwicensium* var. *molokaiense* is not included in the list of species in Hawaii's 2005 Comprehensive Wildlife Conservation Strategy (Mitchell *et al*. 2005).

COORDINATION WITH STATES

On February 11, 2010, we provided the Hawaii Division of Forestry and Wildlife with copies of our most recent candidate assessments for their review and comment. No additional information or comments were received.

LITERATURE CITED

Carlquist, S. 1980. Hawaii: a natural history, second edition. Pacific Tropical Botanical Garden, Honolulu. 468 pp.

Cuddihy, L.W., and C.P. Stone. 1990. Alteration of native Hawaiian vegetation; effects of humans, their activities and introductions. Cooperative National Park Resources Studies Unit, University of Hawaii, Honolulu. 138 pp

Diong, C.H. 1982. Population biology and management of the feral pig (*Sus scrofa* L.) in Kipahulu Valley, Maui. Dissertation to the Zoology graduate division of the University of Hawaii. 408 pp.

Dorman, P. 1996. Axis deer in Hawaii. Research paper for Botany Department, Resource Management and Conservation in Hawaii, University of Hawaii. 9 pp. http://www.botany.hawaii.edu/bot350/1996/Dorman/dorman.htm, accessed on March 23, 2007.

Ellshoff, Z.E., D.E. Gardner, C. Wikler, and C.W. Smith. 1995. Annotated bibliography of the genus *Psidium*, with emphasis on *P. cattleianum* (strawberry guava) and *P. guava* (common guava), forest weeds in Hawaii. Cooperative National Park Resources Studies Unit, University of Hawaii, Honolulu, Technical Report 95. 105 pp.

Francis, J.K. (ed.). 2006. *Pluchea indica*. Wildland shrubs of the United States and its territories: thamnic descriptions: volume 1. http://www.fs.fed.us/global/iitf/pdf/shrubs/Pluchea%20carolinensis.pdf, accessed on December 12, 2006.

Hawaii Biodiversity and Mapping Program. 2008. Program database. Unpublished.

Hawaii Biodiversity and Mapping Program. 2006. *Pseudognaphalium sandwicensium* var. *molokaiense*. http://hbmp.hawaii.edu/printpage.asp?spp=PDAST440P4, accessed on April 14, 2007.

Hawaii, Department of Land and Natural Resources. 1985. Hunting in Hawaii, fourth revision. Division of Forestry and Wildlife, Honolulu, 32 pp.

Hawaii, Department of Land and Natural Resources. 1999. Rules regulating game mammal hunting, updated 2003. 56 pp.

Loope, L., A.C. Medeiros, and B.H. Gagne. 1991. Recovery of vegetation of a montane bog following protection from feral pig rooting. Cooperative National Park Resources Studies Unit, University of Hawaii, Honolulu, Technical Report 77. 23 pp.

Loope, L.L. and A.C. Medeiros. 1992. A new and invasive grass on Maui. Newsletter of the Hawaiian Botanical Society 31: 7-8

Loope, L., F. Starr, and K. Starr. 2004. Protecting endangered Hawaiian plant species from displacement by invasive plants on Maui, Hawaii. Weed Technology 18: 1472-1474.

Mangel, M., and C. Tier. 1994. Four facts every conservation biologist should know about persistence. Ecology 75: 607-614.

Medeiros, A.C., L.L. Loope, T. Flynn, S.J. Anderson, L.W. Cuddihy, K.A. Wilson. 1992. Notes on the status of an invasive Australian tree fern (*Cyathea cooperi*) in Hawaiian rain forests. American Fern Journal 82: 27-33.

Medeiros, A.C., L.L. Loope, P. Conant, S. McElvaney. 1997. Status, ecology, and management of the invasive plant, *Miconia calvescens* DC (Melastomataceae) in the Hawaiian Islands. Bishop Museum Occasional Papers 48: 23-36.

Meyer, J.-Y., and J. Florence. 1996. Tahiti's native flora endangered by the invasion of *Miconia calvescens* D.C. (Melastomataceae). Journal of Biogeography 23: 775-781.

Mitchell, C., C. Ogura, D.W. Meadows, A. Kane, L. Strommer, S. Fretz, D. Leonard, and A. McClung. 2005. Hawaii's comprehensive wildlife conservation strategy. Department of Land and Natural Resources, Honolulu, Hawaii. 722 pp.

Pimm, S., H.L.Jones, and J. Diamond. 1988. On the risk of extinction. American Naturalist 132: 757-785.

Pacific Island Ecosystems at Risk. 2006a. *Cenchrus ciliaris*. http://www.hear.org/Pier/species/cenchrus_ciliaris.htm, accessed on March 15, 2007.

Pacific Island Ecosystems at Risk. 2006b. *Prosopis pallida*. http://www.hear.org/Pier/species/prosopis_pallida.htm, accessed on March 15, 2007.

Robichaux, R., J. Canfield, F. Warshauer, L. Perry, M. Bruegmann, and G. Carr. 1998. "Radiating" plants-adaptive radiation. Endangered Species Bulletin November/December. Pp. 3-5.

Sherff, E.E. 1948. A new variety of *Gnaphalium sandwicensium* Gaud. in the Hawaiian islands. Lloydia 11: 309.

Smathers, G.A. and D.E. Gardner. 1978. Stand analysis of an invading firetree (*Myrica faya* Aiton) population, Hawaii. Proceedings of the Second Conference on Natural Science, Hawaii Volcanoes National Park. Pp. 274-288.

Smith, C.W. 1985. Impact of alien plants on Hawaii's native biota. *In* Hawaii's Terrestrial Ecosystems: Preservation and Management. Stone, C.P., and J.M. Scott (eds.), Cooperative National Park Resources Studies Unit, University of Hawaii, Honolulu. Pp. 180-250.

Spatz, G., and D. Mueller-Dombois. 1973. The influence of feral goats on koa tree reproduction in Hawaii Volcanoes National Park. Ecology 54: 870-876.

The Nature Conservancy of Hawaii. 2007. Moomomi Preserve. http://www.nature.org, accessed on April 14, 2007.

Tomich, P.Q. 1986. Mammals in Hawaii; a synopsis and notational bibliography. Bishop Museum Press, Honolulu. 375 pp.

University of Florida. 2005. *Setaria parviflora*. Center for Aquatic and Invasive Plants, Aquatic, Wetland and Invasive Plant Particulars and Photographs. http://plants.ifas.ufl.edu/setpar.html, accessed on March 26, 2007.

Vitousek, P.M., C.M. D'Antonio, L.L. Loope, M. Rejmanek, and R. Westerbrooks. 1997. Introduced species: a significant component of human-caused global change. New Zealand Journal of Ecology 21: 1-16.

Wagner, W.L., D.R. Herbst, and S.H. Sohmer. 1999a. Manual of the flowering plants of Hawaii. University of Hawaii Press and Bishop Museum Press, Honolulu. Bishop Museum Special Publications 83: 1-1853.

Wagner, W.L., M.M. Bruegmann, J.Q.C. Lau. 1999b. Hawaiian vascular plants at risk: 1999. Bishop Museum Occasional Papers: 60 1-58.

Wagner, W.L. and D.R. Herbst. 2003. Electronic supplement to the manual of flowering plants of Hawaii, Version 3.1. December 12, 2003. http://rathbun.si.edu/botany/pacificislandbiodiversity/hawaiianflora/supplement.htm.

Wagner, W.L. 1997. *Pseudognaphalium sandwicensium* (Gaudich.) Anderb.var. *molokaiense* (O. Deg. & Sherff). Bishop Museum Occasional Papers 48: 54.

Waring, G.H. 1996. Preliminary study of the behavior and ecology of axis deer on Maui, Hawaii. Department of Zoology, Southern Illinois University, Carbondale, http://www.hear.org/AlienSpeciesInHawaii/waringreports/axisdeer.htm, accessed on December 20, 2006.

Wood, K.R. and S. Perlman. 1997. Maui 14 plant survey final report. National Tropical Botanical Garden. 25 pp.

Personal Communications and in litt.

Anderson, S., University of California-Davis, Interview in the Honolulu Advertiser, "Groups urge Maui County to Control Axis Deer," by T. Hurley, August 25, 2001.

Kallstrom, R. The Nature Conservancy, Response to request for information on Red List species for IUCN from Kelly Gravuer, August 7, 2008.

Moses, W., The Nature Conservancy, Response to request for candidate plant species information, September 15, 2006.

Nichols, P., Molokai Ranch, Interview in "Good points squeek out of Laau meeting series", article in *The Molokai Times*, B. Purtzer, June 11, 2006.

Nishibayashi, E., The Nature Conservancy wildlife biologist, Interview in the *Star-Bulletin*, "Deer Population Boom Threatens Maui Forests, Farms," by G.T. Kubota, August 28, 2001.

Seidman, S., Maui Nui Botanical Gardens, Response to request for propagation information, July 25, 2006.

Simpson, J., Kula farmer, Interview in the *Star-Bulletin*, "Deer Population Boom Threatens Maui Forests, Farms," by G.T. Kubota, August 28, 2001.

Starr, F., U.S.G.S. Biological Resources Discipline, Response to request for candidate plant species information, August 11. 2006.

APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve:

Acting Carolyn A. Bohan 5/18/10
Regional Director, Region 1, Fish and Wildlife Service Date

Rowan W Gould
ACTING
Director, Fish and Wildlife Service October 22, 2010

Concur:

Do not concur: _____ Date: _____
Director, Fish and Wildlife Service

Director's Remarks:

Date of annual review: Date: April 21, 2010
Conducted by: Cheryl Phillipson, Pacific Islands FWO
Biologist, Prelisting and Listing Program

Comments:

PIFWO Review

Reviewed by: Christa Russell Date: April 26, 2010
Prelisting and Listing Program Coordinator

Marilet Zablan Date: April 26, 2010
Assistant Field Supervisor, Endangered Species Division

Gina Shultz Date: April 30, 2010
Acting Field Supervisor